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Assessing Gas and Oil Resources in the Intermountain West

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ASSESSING GAS AND OIL RESOURCES IN THE INTERMOUNTAIN WEST

Testimony of Debra Knopman[1]

Associate Director of RAND Science & Technology

Thank you, Madam Chairman, for the opportunity to testify before the Subcommittee on Energy and Mineral Resources about methods of assessing oil and gas resources. At this time, I ask that my full written statement be entered into the record.

I am a Senior Engineer at RAND and a member of the study team for RAND's just released interim report "Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach" and for an abridged version of that work in a paper entitled "A New Approach to Assessing Gas and Oil Resources in the Intermountain West." These publications are interim products of a study that we expect to complete this summer. The research is funded by the William and Flora Hewlett Foundation. Here with me today are two of my RAND co-authors on those publications, Dr. Tom LaTourrette and Dr. Mark Bernstein.

We are at approximately the midpoint of our study. We have completed the following tasks:

- A review of existing resource assessment methodologies and results
- An evaluation of recent studies of federal lands access restrictions in the Intermountain West
- Consideration of a set of criteria that can be used to define the "viable" hydrocarbon resource, with particular attention to issues relevant to the Intermountain West

We still plan to more fully address the development of a comprehensive assessment methodology for the viable resource, and then apply this methodology to Intermountain West basins.

Given the challenge of developing such a methodology, as well as its relevance to the current debate on energy policy, we believe that it was important to release this interim report at this time. By doing so, we have created the opportunity to gather additional feedback on our proposed methodology as we proceed with the next phase of work.

RAND's interest in this issue, as it is in all our work, is to improve decision-making through research and analysis. We are an independent non-profit organization, dedicated to producing objective, non-partisan analysis. Our publications are subjected to rigorous peer review and quality assurance in which we actively seek internal and outside experts to critique our work. The research upon which this testimony is based has been through this quality assurance process.

Let me introduce a summary of our work to date by saying that RAND does not have a position on whether oil and gas exploration and development should proceed on currently restricted federally managed lands. This is a complex policy question with several competing considerations, including the nation's need for long-term, reliable, and clean energy supplies. Rather, our interest is in the quality, relevance, and transparency of the technical information that surrounds the public debate on future development. We are also interested in encouraging a broader discussion about constraints on exploration and development beyond that of access restrictions applied to federal lands. We believe that improved public understanding of the range of estimated costs and impacts of development and associated infrastructure, under different

technology and economic assumptions, will contribute significantly to debate on national energy and land management policies.

Our main point can be summarized as follows: The debate over access to gas and oil resources on federally managed lands in the Intermountain West would benefit from an improved understanding of how much resource might actually be developed and at what costs. Our study recommends developing and publicly reporting estimates of "viable" resources in the region, using a step-wise approach that incorporates a set of economic and environmental criteria. We also recommend ways in which the Bureau of Land Management's (BLM's) on-going basin-specific studies on the impact of access restrictions could be further enhanced.

A broader framing of the debate about potential development of oil and gas resources is important for two primary reasons. First, most states and regions are in the process of planning for substantial future dependence on natural gas as their dominant electricity-generating fuel. Given this, decisionmakers and the public would benefit from a more comprehensive view of prospective costs and availability of long-term domestic supplies of natural gas and oil. Second, it makes sense for federal land managers, as well as Congress and the public, to focus concerns about access restrictions on those resources that are prime candidates for production given economic viability and environmental considerations.

SOME POLICY QUESTIONS REQUIRE MORE INFORMATION THAN WHAT TRADITIONAL ASSESSMENTS PROVIDE

The goal of traditional resource assessments is to estimate the nation's potential supply of natural gas and oil resources. As part of our research, we examined four recent assessments: the U.S. Geological Survey National Oil and Gas Resource Assessment Team, 1995; Minerals Management Service, 2000; National Petroleum Council, 1999; and Potential Gas Committee, 2001.[2] Although the assessments vary, they agree that the Intermountain West contains substantial natural gas and oil resources.

These assessments estimate what is called the "technically recoverable" resource[3]—the amount of the resource that is estimated to be recoverable given certain assumptions about exploration and production capabilities. Resources are evaluated in terms of geological criteria and technical feasibility of recovery, but without economic or other considerations. These estimates, therefore, are not intended to indicate how much resource will likely be developed and at what cost.

An enhancement to these assessments would be a range of estimates of the resource that can be "viably produced," under varying assumptions about future energy prices, exploration scenarios, and current and emerging development technologies. Determining the oil and gas resources that are viable to produce depends on three main factors: (1) exploration and production costs (those costs incurred in getting the resource to the wellhead); (2) infrastructure and transportation costs (those costs incurred in getting the resource to the market); and (3) potential environmental impacts.

It is important to note at this point that we highly value these existing expert resource

assessments, and that we are in no way suggesting that they are inadequate for their intended purpose. Indeed, our proposed methodology builds on them. We are simply saying that more comprehensive estimates of resources likely to be developed would better focus policy discussion on key policy questions, such as, for example, the projected adequacy of supply and future cost of natural gas; and the overall effectiveness or hindrance of access restrictions in meeting future energy demand with adequate environmental safeguards.

PROPOSED METHODOLOGY TO ESTIMATE THE VIABLE RESOURCE

Our proposed methodology is designed to generate a series of map views of resources favorable for development under varying assumptions about energy prices, technology, and environmental impacts. A resource would be economically viable if the revenue expected from the developed resource is likely to exceed the costs of exploration, production, infrastructure, and transportation. Environmental impacts are difficult to predict. We intend to devise measures of existing environmental conditions and examine implications of change in those conditions. We will classify areas based on a selected set of water quality, air quality, and ecological measures, and relate these measures to existing environmental standards.

We believe that one useful perspective is to look at these factors sequentially, beginning with the economic criteria. If the costs of getting resources from the wellhead to market would preclude development under some set of assumptions, then environmental considerations would not come into play.

Similarly, the extent and need for various access restrictions on federal lands can be viewed in the context of economic viability. Indeed, industry uses this same process of assessing the

viability of developing oil and gas resources, whether on federal or non-federal lands. Industry would be unlikely to pursue development if the costs of getting the resource out of the ground and to market exceeded revenue projections, or potential environmental concerns were viewed as significant and likely to be contentious. In essence, our proposed methodology would more systematically bring to the public discussion the multiple factors, including economic costs and environmental impacts, that industry must address before making a decision to move forward with development on public lands.

BUILDING A COMPREHENSIVE RESOURCE ASSESSMENT METHODOLOGY

The three factors cited above – exploration and production costs, infrastructure and transportation costs, and environmental impacts -- reflect well-known and often cited issues that determine the availability of gas and oil resources. Aspects of these issues have been addressed to varying degrees in previous studies.[4] However, the factors are generally not all considered in resource assessment methodologies. Building a comprehensive methodology that does so to the public's benefit is challenging.

RAND intends to develop an assessment tool that would produce ranges of estimates of resources that account for uncertainties. This tool would allow decisionmakers to vary assumptions about costs and constraints at each step of the analysis, improve understanding of the sensitivity of results to those assumptions, and determine the value of reducing data uncertainties within the analysis. For example, should the federal government increase investments to enhance existing assessments of the technically recoverable resource? How dependent are the results on assumptions about technological change? These are important questions to ask (and answer) for decisionmakers faced with reducing risks in long-term energy

contracts or land managers faced with multiple choices about changing access restrictions.

Exploration and Production Costs

Estimating economic viability involves balancing exploration and production costs with resource revenues to determine if it would be economically logical to proceed with production.[5] Such costs, commonly referred to as "wellhead" costs, include exploration and development drilling, well completion, lease equipment, operations and maintenance, taxes and royalties; return on investment would also be included in this category.

Estimates of economic recoverability in the Rocky Mountain Region are inherently uncertain and are hence best represented as a range of estimates rather than as a single point estimate. However, by way of illustration, a 1998 U.S. Geological Survey study indicated that, at a regional scale, significant amounts of gas and oil resources may not be economically viable for production in the foreseeable future. The USGS results (using 1994 data) showed that adding economic viability alone would rule out, in the near term, the recovery of a large fraction of the gas resource that would otherwise be deemed technically recoverable from the Green River Basin.[6] Of course, it is important to note that technological improvements and changing economic conditions have altered these estimates over time, particularly regarding the costs of developing nonconventional resources. Technology in this area is progressing rapidly, and the economically recoverable fractions are likely to be higher today than those reported in the USGS study.

Industry assessments of wellhead costs are tailored to reflect the unique costs of gas and oil exploration and production in the Intermountain West. We propose that a comprehensive

assessment of the viable resource in the public domain reflect these differential costs. Further, a comprehensive assessment should account for differential costs resulting from the high abundance of nonconventional gas in the Rockies[7]; well completion, lease equipment, and operating costs can be higher for low-permeability (tight) sandstone and coalbed methane deposits. It is also important to use, whenever available, local drilling success ratios, rather than regional averages of existing wells, since using ratios from existing wells biases assessments toward conventional deposits. Finally, other unique factors need to be addressed, including the steep and rugged terrain, remote locations, low-quality gas, and shallow formations.

Infrastructure Costs

Turning now to infrastructure costs, much of the economically viable resources in the Intermountain West cannot be developed without constructing additional pipeline and road infrastructure. Again, these are costs that industry knows well. We propose that a comprehensive assessment in the public domain reflect estimates of these costs as well. Capital expenditures and operating costs for infrastructure, in general, are comparatively high in the Rocky Mountain Region because of less existing infrastructure relative to other regions. If required, new infrastructure could add substantial costs beyond the wellhead costs alone.

As was true in assessing wellhead costs, some complicating factors need to be considered in assessing infrastructure costs in the Rocky Mountain Region. These include the remoteness of existing pipeline infrastructure, particularly transmission pipelines; the rough terrain, unstable soil, and icing in colder climates; the extensive water disposal requirements associated with coalbed methane deposits; and the potential need for compressor capability to transport low-pressure gas from nonconventional deposits. In addition, produced water and other wastes may

need to be removed from the site, in some cases requiring additional pipeline capacity.

Environmental Impact

Finally, we believe that there is value in looking more specifically, within the context of existing laws, at varying levels of change in existing environmental conditions that could occur as a consequence of exploration and development. We will likely use individual indicators to track a spectrum of conditions, including air quality, water quality, soil properties, hazardous materials, protected species, migration patterns, vegetation habitats, and land use. These conditions can be categorized and mapped to enable decisionmakers to understand the spatial distribution of existing environmental conditions within a total resource area. We do not intend to predict environmental impacts, but instead, we intend to show how varying environmental conditions relative to existing environmental standards could affect estimates of the viable resource.

It is, again, important to note that RAND has not performed a comprehensive assessment of any area yet. We have focused the first phase of our work on developing a framework that would guide such an assessment.[8]

CONCLUDING THOUGHTS

Assumptions about the viability of resources -- inherently uncertain under any method -- need to be carefully examined for either excessive conservatism or optimism. A guiding principle of sound analysis is that there be consistency in whatever kinds of assumptions are used in assessment studies. For example, assessments that mix overly conservative assumptions about, say, drilling technologies with overly optimistic assumptions about wellhead costs or infrastructure economics are not useful for policymaking. In the context of understanding future

domestic energy supply scenarios, consistency needs to further extend beyond a limited focus on selected federal lands and toward a broader view of assessment on all lands.

There are legitimate questions about the appropriate federal role in examining the economics of exploration and development scenarios. Our proposed approach is not meant to replace industry's detailed, site-specific economic evaluations or federal land managers' existing environmental assessment and permitting processes. Rather, it is meant to provide decisionmakers with a more comprehensive assessment of bounding ranges of resource viability at the regional and subregional scale. We believe our proposed methodology would enhance current efforts by the BLM and other federal land managers to communicate more effectively and clearly the economics and environmental implications of their actions. We are simply arguing for more comprehensive information in the policy process.

This concludes my testimony. I welcome any questions you may have. Thank you.

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[1]RAND Senior Engineer and Associate Director of the RAND Science and Technology Program. In this testimony, I draw on the following RAND study: Tom LaTourrette, Mark Bernstein, Paul Holtberg, Chris Pernin, Ben Vollaard, Mark Hanson, Kathryn Anderson, and Debra Knopman, *Assessing Gas and Oil Resources in the Intermountain West: Review of Methods and Framework for a New Approach*, RAND MR-1553-WFHF, Santa Monica, California, 2002. The opinions and conclusions expressed in this written testimony are the author's alone and should not be interpreted as representing those of RAND or any of the sponsors of its research.

[2]The four assessments are as follows: U.S. Geological Survey National Oil and Gas Resource Assessment Team, *1995 National Assessment of United States Oil and Gas Resources*, U.S. Geological Survey Circular 1118, 1995; Minerals Management Service, *Outer Continental Shelf Petroleum Assessment, 2000*, U.S. Minerals Management Service, 2000; National Petroleum Council, *Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand*, National Petroleum Council, 1999; and Potential Gas Committee, *Potential Supply of Natural Gas in the United States*, Potential Gas Agency, Golden, CO, 2001.

[3]In practice, the definition of the term "technically recoverable" is unclear and is inconsistently applied among the different assessments. A large part of the difference between existing resource assessments results from differing assumptions as to what constitutes a technically recoverable resource.

[4]See, for example, Harry E. Vidas, Robert H. Hugman, and David S. Haverkamp, *Guide to the Hydrocarbon Supply Model: 1993 Update*, Gas Research Institute, Report GRI-93/0454, 1993; Emil D. Attanasi, *Economics and the 1995 Assessment of United States Oil and Gas Resources*, U.S. Geological Survey Circular 1145, 1998; and National Petroleum Council, *Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand*, National Petroleum Council, 1999.

[5]Harry E. Vidas, Robert H. Hugman, and David S. Haverkamp, *Guide to the Hydrocarbon Supply Model: 1993 Update*, Gas Research Institute, Report GRI-93/0454, 1993; and Emil D. Attanasi, *Economics and the 1995 Assessment of United States Oil and Gas Resources*, U.S. Geological Survey Circular 1145, 1998.

[6]Emil D. Attanasi, *Economics and the 1995 Assessment of United States Oil and Gas Resources*, U.S. Geological Survey Circular 1145, 1998. The U.S. Geological Survey economic assessment accounts for current technology only. As a result, its economic assessment is generally considered to be more conservative than the assessments used by industry. The data and forecasting assumptions used in the USGS study are current as of about 1994. It is important to note that technological improvements and changing economic conditions will alter these estimates over time. The use of more current recoverable resource estimates and cost assumptions will undoubtedly alter the results, particularly regarding the costs of developing nonconventional resources. Technology in this area is progressing rapidly, and the economically recoverable fractions are likely to be higher today than reported in the USGS study.

[7]Nonconventional resources include low-permeability (tight) sandstone, shale, chalk, and coalbed methane.

[8]RAND will begin this effort by analyzing the Green River Basin. The analysis will specify the relationships among gas and oil deposits, technological options, economic costs, infrastructure requirements, environmental sensitivities, and other variables to allow for a comprehensive assessment of the viable gas and oil resource.